

SCHOOL

Trial WACE Examination, 2011

Question/Answer Booklet

MATHEMATICS 2A/2B

Section Two:
Calculator-assumed

SOLUTIONS

Student Number: In figures

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In words

Your name

Time allowed for this section

Reading time before commencing work: ten minutes

Working time for this section: one hundred minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet

Formula Sheet (retained from Section One)

To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid/tape, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this examination.

Important note to candidates

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	50	33
Section Two: Calculator-assumed	12	12	100	100	67
Total				150	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2011*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in the spaces provided in this Question/Answer Booklet. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.
3. **Show all your working clearly.** Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.
4. It is recommended that you **do not use pencil**, except in diagrams.

Section Two: Calculator-assumed

(80 Marks)

This section has twelve (12) questions. Answer all questions. Write your answers in the spaces provided.

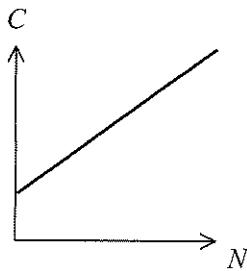
Working time for this section is 100 minutes.

Question 8

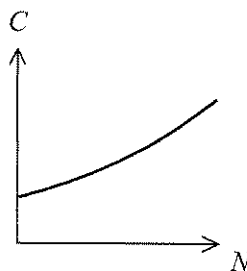
(5 marks)

The cost of electricity, C in dollars, is directly proportional to the number of units of electricity consumed, N .

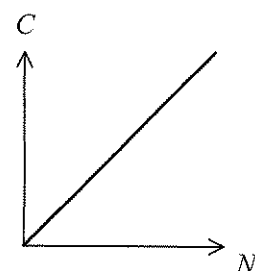
- (a) Which one of the graphs below best show the relationship between N and C ? (1 mark)



Graph 1



Graph 2



Graph 3

Graph 3 - straight line through origin.



- (b) If 540 units of electricity cost \$102.06,

- (i) how much will 270 units cost?

(2 marks)

$$1 \text{ unit costs } 102.06 \div 540 = 0.189$$

$$270 \times 0.189 = \$51.03$$

✓✓ (allow answer only)

- (ii) how many units of electricity could be bought for \$94.50?

(2 marks)

$$94.50 \div 0.189 = 500 \text{ units}$$



(accept answer only)

Question 9

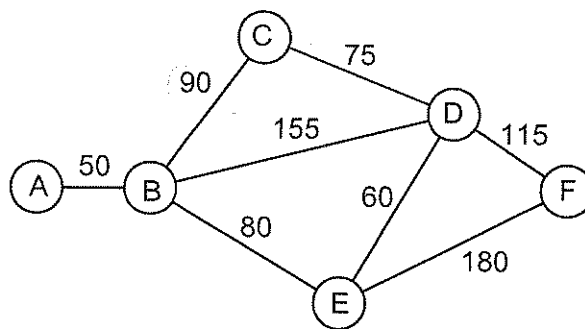
(8 marks)

The distances, in metres, along direct paths between six campsites, A, B, C, D, E and F, are shown in the table below. Not all of the campsites have direct paths between them.

	A	B	C	D	E	F
A		50				
B	50		90	155	80	
C		90		75		
D		155	75		60	115
E		80		60		180
F				115	180	

(a) Draw a network diagram to represent this information.

(3 marks)



✓✓✓ (-1 for each error)

(b) Is the network above traversable? If yes, state where you would start and finish. If not, explain why not. (2 marks)

Yes. ✓
Start at A and finish at E (or vice versa)

✓ (or other soln)

(c) List the shortest route to travel from campsite A to F along the above network of paths and state the length of this route. (3 marks)

A to B to E to D to F.
Length is 305 metres.

✓✓
✓

Question 10

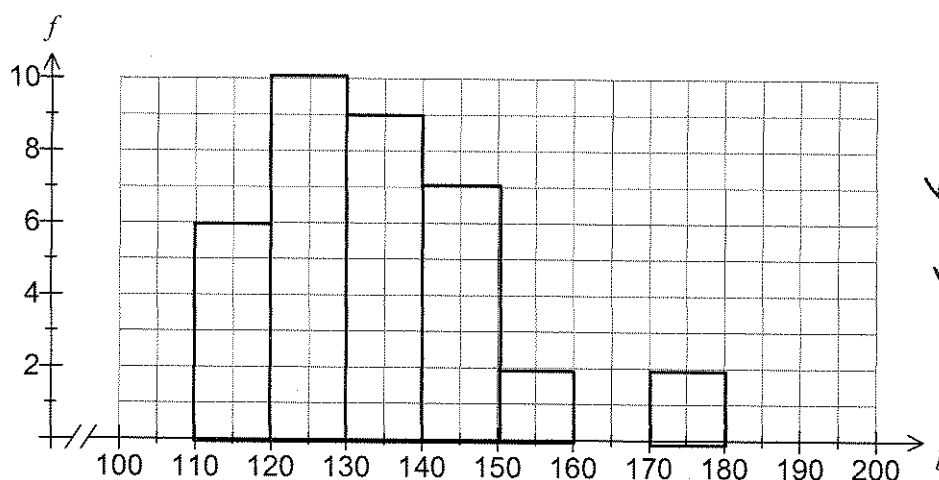
(9 marks)

As part of a study into the effect of exercise on health, the heart beat of 36 women were recorded after five minutes of weight-lifting. The results are shown in the table below.

Heart beat, b (bpm)	Number of women
$110 \leq b < 120$	6
$120 \leq b < 130$	10
$130 \leq b < 140$	9
$140 \leq b < 150$	7
$150 \leq b < 160$	2
$160 \leq b < 170$	0
$170 \leq b < 180$	2

(a) Construct a frequency histogram for this data on the axes below.

(3 marks)



✓✓ accuracy
✓ ruler

(b) Determine the mean heart beat for the group of women, rounding your answer to the nearest whole number.

(2 marks)

$$\bar{x} = 134.17$$

$$\approx 134 \text{ bpm}$$

✓
✓ (for rounding)

(c) What percentage of the group had a heart beat of at least 140 bpm?

(2 marks)

$$\frac{7 + 2 + 2}{36} \times 100 = \frac{1100}{36} \approx 30.6\%$$

✓✓

(d) Describe the spread of the data.

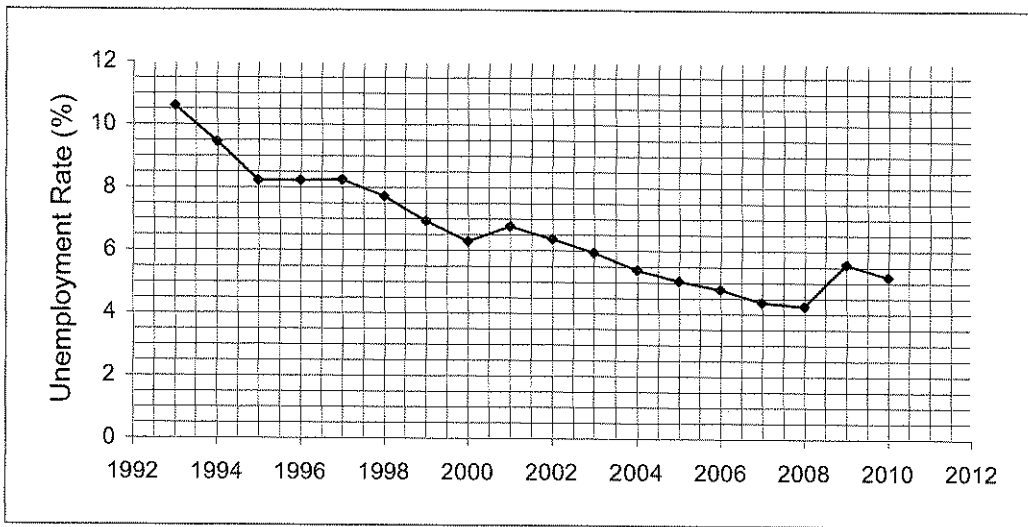
(2 marks)

Most of the data is clustered between 110 and 150 bpm, with just 4 of the 36 women outside this interval. There is a gap in the data between 160 and 170 bpm, with just 2 women above this, indicating they may both be outliers.

Question 11

(6 marks)

The unemployment rate in Australia from 1993 to 2006 is shown on the graph below.



- (a) Data for another four years is given in the table below. Use this data to extend the above graph until the year 2010. (2 marks)

Year	2007	2008	2009	2010
Unemployment rate (%)	4.4	4.2	5.6	5.2

✓ accuracy
✓ joining

- (b) In which year was the unemployment rate 6%? (1 mark)

2003 ✓ (r/w)

- (c) Describe the trend in unemployment shown by the graph. (1 mark)

The trend for unemployment is decreasing with time. ✓

- (d) In which year(s) did the unemployment rate not follow the trend? Explain your answer. (2 marks)

1996 and 1997 - stayed steady. ✓
200~~7~~ and 2009 - increased from previous years. ✓

Question 12

(10 marks)

A hardware store sells 300 mL cans of stain for \$7 and larger 500 mL cans of the same product for \$11.

- (a) Which can of stain represents the best value? Show your reasoning. (3 marks)

$300 \div 7 = 42.9 \text{ mL per } \$$ $500 \div 11 = 45.5 \text{ mL per } \$$ Hence larger size is best value.

✓
 ✓
 ✓ (must state)

- (b) If the store bought the 300 mL cans for \$5.60, what percentage profit do they make by selling them for \$7? (2 marks)

$7.00 - 5.60 = 1.40 \text{ profit}$ $1.40 \div 7.00 = 0.25$ $= 25\% \text{ profit}$

✓
 ✓

- (c) A customer buys 12 litres of stain for \$272 by purchasing x of the smaller cans and y of the larger cans.

- (i) Write an equation using x and y for the cost of the paint. (1 mark)

$7x + 11y = 272$

✓

- (ii) Write another equation using x and y for the amount of paint bought. (Note that one litre is the same as 1 000 mL) (2 marks)

$0.3x + 0.5y = 12$

✓ ✓

- (iii) Solve your two equations simultaneously to determine how many of each size can were bought. (2 marks)

$x = 20, y = 12$ 20 small cans and 12 large cans.
--

✓
 ✓ (if stated)

Question 13

(10 marks)

Box A contains 3 tennis balls, 8 hockey balls and 12 cricket balls. Each of the balls in box A have the same chance of being chosen.

- (a) What is the probability of choosing a cricket ball **or** a hockey ball from box A? (2 marks)

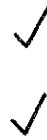
$$\frac{12 + 8}{12 + 8 + 3} = \frac{20}{23}$$



Box B contains 15 tennis balls, 11 hockey balls and 8 cricket balls. Each of the balls in box B has the same chance of being chosen.

- (b) What is the probability of **not** choosing a cricket ball from box B? (2 marks)

$$1 - \frac{8}{15 + 11 + 8} = 1 - \frac{8}{34} = \frac{26}{34}$$



- (c) A hockey ball is chosen. From which box is it more likely to have come from, A or B? Justify your answer. (3 marks)

$$P(\text{Hockey from box A}) = \frac{8}{23} \approx 0.348$$

$$P(\text{Hockey from box B}) = \frac{11}{34} \approx 0.324$$

Most likely to come from box A.



- (d) 50 balls were selected at random from another box, C, each ball being returned to the box before the next was chosen. Of these 50, eighteen were tennis balls. If box C contained a total of 17 balls, with an equal number of tennis and hockey balls and the rest being cricket balls, what was the most likely number of each type of ball in box C? (3 marks)

$$P(\text{Tennis ball}) = \frac{18}{50}$$

In box C expect $\frac{18}{50} \times 17 = 6.12 \approx 6$ tennis balls.

Hockey same as tennis, so expect 6 hockey balls.

Rest must be cricket, so $17 - 12 = 5$ cricket balls.

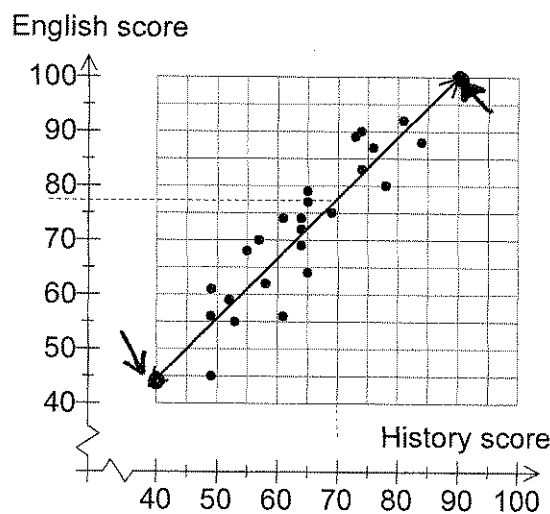
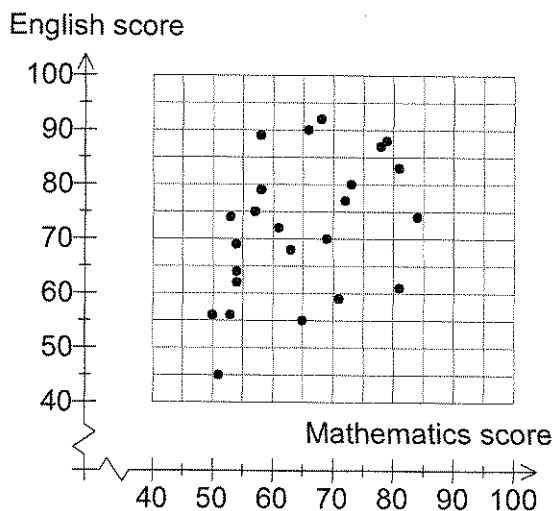


Question 14

(10 marks)

A class of 25 students took examinations in three subjects: English, Mathematics and History.

One of the students was absent for the English examination. The two scatterplots below show the percentage scores for the 24 students who sat all three examinations.



- (a) What was the History score for the student who scored 65% in Mathematics? (2 marks)

65% Maths scored 55% in English.
55% in English scored 53% in History.

✓✓ (answer only)

The student who was absent for the English examination scored 70% in History and 75% in Mathematics.

- (b) Which of the two scatterplots would be best to fit a trend line to, in order to predict the English score for the absent student? Explain your reasoning. (2 marks)

History v English.
There is a more obvious trend between History and English as the points lie closer to a straight line when compared to the Mathematics and English data.

✓
✓ (explanation)

- (c) Draw in a trend line on the scatterplot you chose in part (b). ✓✓ check 2 points (2 marks)

- (d) Show how to use your trend line to predict the English score for the absent student and write down this prediction. (2 marks)

77%

✓✓ (accept answer only)

- (e) Comment on the reliability of your prediction in part (d). (2 marks)

Good, because the prediction involves interpolation and the trend is fairly strong.

✓ interpolation
✓ strong trend

Question 15

(6 marks)

A box of 100 drawing pins was emptied onto a table in a random manner, with 37 landing pin up and the rest pin down. Some of the drawing pins are shown here.



- (a) Estimate the probability of one drawing pin landing pin down.

(2 marks)

$$\frac{100 - 37}{100} = \frac{63}{100}$$



- (b) If a smaller box of 60 of the same type of drawing pins was emptied onto the table, how many would you expect to land pin down?

(2 marks)

$$\frac{63}{100} \times 60 = 37.8$$

Hence expect about 38 to land pin down.

✓ (calc)

✓ (for 38)

- (c) If the original box of 100 drawing pins was emptied onto the table for a second time, and in a similar manner, would you expect 37 to land pin up again? Explain your answer.

(2 marks)

No.
The exact number landing pin up is unpredictable, although the relative frequency of the number landing pin up will stabilise for a large number of trials.



✓ explanation

Question 16

(8 marks)

- (a) A sphere has a radius of 5 cm and cube has a side length of 80 mm. Which solid has the greatest volume, and by how much? (4 marks)

$$V_S = \frac{4}{3} \times \pi \times 5^3$$

$$= 523.6 \quad \checkmark$$

$$80 \text{ mm} = 8 \text{ cm}$$

$$V_C = 8^3$$

$$= 512 \quad \checkmark$$

$$523.6 - 512 = 11.6 \quad \checkmark$$

Sphere has greatest volume by 11.6 cm³ \checkmark (stated)

- (b) What is the side length of a cube that has the same surface area as a cylinder with a height of 20 cm and a radius of 8 cm? Round your answer to 1 decimal place. (4 marks)

$$A_{CYL} = 2 \times \pi \times 8 \times 20 + 2 \times \pi \times 8^2$$

$$= 1407.4 \quad \checkmark \checkmark$$

$$A_C = 6l^2$$

$$6l^2 = 1407.4 \quad \checkmark$$

$$l^2 = 234.6$$

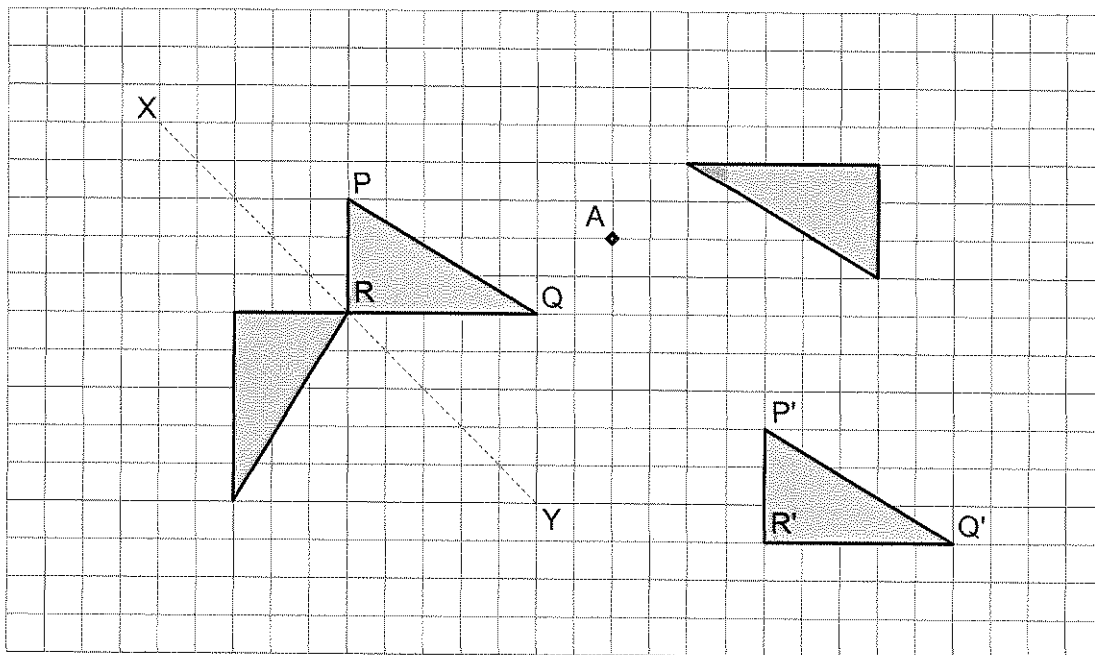
$$l = \sqrt{234.6}$$

$$l = 15.3 \text{ cm (1dp)} \quad \checkmark$$

Question 17

(8 marks)

Consider the triangle PQR drawn below.

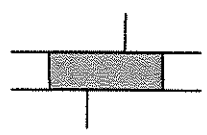


- (a) Draw the position of triangle PQR after it has been reflected in the dotted line XY. (2 marks)
reflected XY ✓ correct reflection
- (b) Draw the position of triangle PQR after it has been rotated 180° about point A. (2 marks)
rotated 180° ✓ about A ✓
- (c) Describe the transformation of triangle PQR to triangle P'Q'R'. (2 marks)

Translation of
11 units right and 6 units down.

✓ ✓

(d) Consider this figure



- (i) How many lines of symmetry, if any, does this figure have? (1 mark)

None

✓ *(r/w)*
- (ii) What is the order of rotational symmetry, if any, for this figure? (1 mark)

Order 2.

✓ *(r/w)*

Question 18

(7 marks)

Sheets of A3, A4 and A5 paper have a width to height ratio of 29:41.

- (a) If a sheet of A3 paper has a width of 297 mm, determine the height of the sheet. (2 marks)

$$\begin{aligned} 297 \times \frac{41}{29} &= 419.9 \\ &\approx 420 \text{ mm} \end{aligned}$$

✓
✓ (2 marks for 419.9 or 420)

- (b) How long is the diagonal of a sheet of A5 paper, which has a height of 210 mm? (3 marks)

$$\begin{aligned} 210 \times \frac{29}{41} &= 148.5 \\ \sqrt{148.5^2 + 210^2} &= 257.2 \\ &\approx 257 \text{ mm} \end{aligned}$$

✓
✓
✓ (1 mark for 257.2 or 257)

- (c) A sheet of A3 paper is cut along its diagonal into two congruent right triangles.

Use trigonometry to determine the size of the smallest angle in one of these triangles.

(2 marks)

$$\begin{aligned} \tan \theta &= \frac{297}{420} \\ \theta &= 35^\circ \end{aligned}$$

✓
✓ (accept answer only)

Question 19

(13 marks)

Two students are simulating their own savings schemes for a 30 day period.

Anne starts off with \$20 and plans to add \$5 per day. She models her total savings, S in dollars, with the relationship $S = 20 + 5d$, where d is the number of days since she began saving.

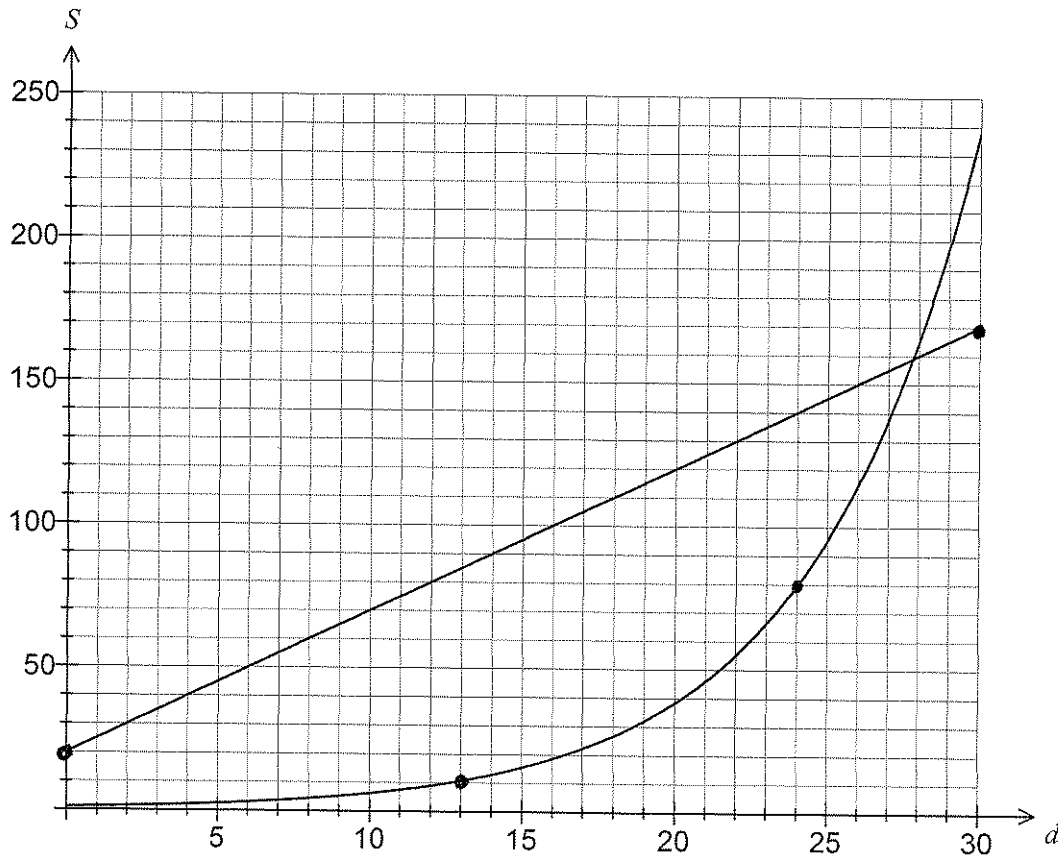
Ben begins with just one dollar and plans to increase his total savings by 20% per day. He models his savings with the relationship $S = (1.2)^d$.

(a) Show that after two days, Anne has \$28.56 more than Ben.

(3 marks)

$d = 2$	
$S_A = 20 + 5 \times 2 = 30$	✓
$S_B = 1.2^2 = 1.44$	✓
$30 - 1.44 = \$28.56$	✓

(b) Assisted by the graphing ability of your calculator, plot the two relationships for the savings of Anne and the savings of Ben on the axes below for the first 30 days. (4 marks)



line ✓ check points (0, 20) exp ✓ (24, 80) check coord
 ✓ + (30, 170) ✓ (13, 10)

- (c) From your graph, when have Anne and Ben both saved similar totals? (1 mark)

Day 28

✓ (r/w)

- (d) Who has saved the most after 30 days, and how much more do they have than the other person? (3 marks)

Ben has saved more:

$S_A = 170$

$S_B = 237.38$

$237.38 - 170 = \$67.38$

✓
✓
✓

- (e) If Anne and Ben extended their savings schemes to run for 100 days, which scheme would you consider being the best? Explain your answer. (2 marks)

Anne's scheme is best from a practical point of view.

Although Ben would have saved far more than Anne due to the exponential nature of his savings, his scheme is very unlikely to continue in practice as after 100 days he would have over \$8 million saved.

✓
✓

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